REMARKS

The rejection of Claims 1-8 under 35 U.S.C. § 103(a) as unpatentable over U.S. 5,082,163 (Kanahara et al) in view of U.S. 6,182,340 B1 (Bishop), U.S. 2002/0010073 A1 (Beall et al), U.S. 6,176,140 B1 (Autenrieth et al), U.S. 6,086,990 (Sumino '990), U.S. 6,107,638 (Sumino '638), U.S. 5,492,730 (Balaba et al), U.S. 5,843,589 (Hoshiya et al), and U.S. 5,310,453 (Fukasawa et al), is respectfully traversed.

As recited in above-amended Claim 1, the present invention is a ceramic heater for a semiconductor-producing/examining device having a heating element formed on a surface of a ceramic substrate or inside a ceramic substrate, wherein: said substrate is made of a non-oxide ceramic containing 0.05 to 5% by weight of oxygen; and the pore diameter of the maximum pore thereof is 50 μm or less.

When the oxygen amount is below 0.05% by weight or over 5% by weight, the breakdown voltage of the ceramic substrate drops at high temperatures. When the pore diameter of the maximum pore is over 50 μm, the breakdown voltage of the ceramic substrate also drops at high temperatures. The present invention insures a high breakdown voltage property at high temperatures by setting the amount of oxygen and the maximum pore of the pore diameter as set forth in Claim 1.

The importance of these parameters is demonstrated in the specification such as by comparing Example 1 and Comparative Example 1. The results are shown in Tables 1 and 2, at pages 36 and 37, respectively, of the specification, a copy of which is **attached herewith**. As shown in Table 2, when operating within the parameters of the present invention, the breakdown voltage was at least 1 kV/mm. On the other hand, in Comparative Example 1, the breakdown voltage was 0.5 kV/mm at 450°C when the amount of oxygen was below 0.05% by weight, although the pore diameter of the maximum pore was 1 μm. When the pore

diameter of the maximum pore was 55 μm, the breakdown voltage at 450°C was as low as 0.4 kV/mm, although the amount of oxygen was 1.6% by weight. When the amount of oxygen was 6% by weight, the breakdown voltage at 450°C was also as low as 0.9 kV/mm, although the pore diameter of the maximum pore was 1 μm. Accordingly, when the amount of oxygen is 0.05 to 5% by weight, the breakdown voltage at high temperature, i.e., such as 450°C, can be specifically raised by setting the pore diameter of the maximum pore to 50 μm or less.

The applied prior art neither discloses nor suggests the presently-claimed invention, nor the above-discussed results.

Kanahara et al disclose a method of metallizing a non-oxide ceramic material with copper by placing the ceramic material either in contact with or in close proximity to copper and heating the material at a predetermined temperature lower than the melting point of copper so as to dissociate at least part of the copper oxide in the copper (paragraph bridging columns 2 and 3. Kanahara et al disclose such metallized non-oxide ceramic materials for use as a high-frequency circuit substrate (column 1, lines 35-36), but neither discloses nor suggests a ceramic heater nor the above-discussed comparative results, which demonstrate superiority when the amount of oxygen and the pore diameter of the maximum pore satisfies the terms of Claim 1. None of the other prior art combined with Kanahara et al remedy the above-discussed deficiencies of Kanahara et al. Bishop relates to a method of manufacturing a piezoelectric transformer or actuator by co-firing the ceramic composition. Contrary to the finding by the Examiner, Bishop actually discloses co-firing in a non-oxidizing atmosphere (column 11, lines 32-35). Thus, Bishop does not relate to a heater and teaches away from the present invention. Beall et al discloses a prior art patent to Merkel et al which discloses a method of forming a cordierite body, which body has, *inter alia*, a median pore diameter of

between 5 and 40 μm ([0011]). Merkel et al's ceramic is an aluminum oxide ceramic, and is thus not a non-oxide ceramic. In addition, Beall et al does not relate to ceramic heater, but rather ceramics for use as catalyst carriers for purifying automobile exhaust gas ([0003]). Autenrieth et al is relied on simply for a disclosure of nitride and carbide non-oxide ceramics, but contains no disclosure with regard the presence of oxygen, or pore diameter, and relates to ceramic sockets, not ceramic heaters. Sumino '990 is drawn to a silicon nitride circuit substrate used for a semiconductor device (column 1, lines 9-14), but disclose and suggest nothing with regard to ceramic heaters, or maximum pore diameter. Sumino '638 is drawn to silicon nitride circuit substrates, but does not disclose or suggest a ceramic heater. While a maximum porosity by volume is disclosed, there is no specific disclosure regarding pore diameter of the maximum pore, nor is there disclosure or suggestion with regard to a particular oxygen range. Balaba et al disclose a siloxane coating process for metal or ceramic substrates. The Examiner relies on Claim 8 therein, which recites a coating step comprising drying a polysiloxane solution onto a metal or ceramic substrate at a temperature in the range of about 75-110°C. However, Balaba et al neither discloses nor suggests a ceramic heater, nor that said heater is capable of operating within a temperature range of 100 to 700°C. Hoshiya et al relates to a magnetic layered material. The Examiner relies on the disclosure therein at column 6, lines 31-46, which the Examiner finds is of a ceramic substrate having a thickness in the range of 25 mm or less, and a diameter in the range of 200 mm or more. However, this disclosure is of a magnetic layered material laminated on a ceramic substrate having a thickness of 1 mm and a diameter of 3 inches, i.e., about 75 mm. Thus, contrary to the finding by the Examiner, the diameter of the ceramic substrate in Hoshiya et al is **not** more than 200 mm. Fukasawa et al relates to a method of processing a substrate, such as a semiconductor wafer, by using a plasma. Fukasawa et al discloses that a refractory metal heating element

may be embedded in a disk-like ceramic base member and a heating resistor and a glass layer may be printed/stacked on a baked ceramic substrate (column 9, lines 54-68). Fukasawa et al further discloses lifter pins for a semiconductor wafer (Fig. 1, column 11, lines 66 to column 12, line 4). However, there is no disclosure or suggestion in Fukasawa et al of a ceramic heater, nor does Fukasawa et al disclose or suggest the above-discussed parameters regarding oxygen content and diameter of the maximum pore.

In sum, the Examiner has combined disparate prior art references, each showing, or purporting to show, individual limitations of the present claims. However, the Examiner has provided no motivation for one skilled in the art to combine this prior art and indeed, one skilled in the art would not have combined them without the present disclosure as a guide. Moreover, even if the prior art were combined, it could not have predicted the above-discussed comparative data, showing superiority when the oxygen content and pore diameter of the maximum pore are within the terms of the present claims.

For all the above reasons, it is respectfully requested that the rejection over prior art be withdrawn.

All of the presently pending claims in this application are now believed to be in

immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,

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IN THE CLAIMS

--1. (Amended) A ceramic [substrate] heater for a semiconductor-producing/examining device having a [conductor] heating element formed on a surface of [the] a ceramic substrate or inside [the] a ceramic substrate,

same?

wherein:

which one

112 said substrate is made of a non-oxide ceramic containing 0.05 to 5% by weight of oxygen; and

the pore diameter of the maximum pore thereof is 50 μm or less.

2. (Amended) The ceramic [substrate] heater for the semiconductor-producing/examining device according to claim 1,

wherein said non-oxide ceramic is a nitride ceramic.

3. (Amended) The ceramic [substrate] heater for the semiconductor-producing/examining device according to claim 1,

wherein said non-oxide ceramic is a carbide ceramic.

4. (Canceled).

5. (Amended) The ceramic [substrate] heater for the semiconductor-producing/examining device according to [any of claims 1 to 4] claim 1,

wherein said ceramic substrate has a porosity of 5% or less.

6. (Amended) The ceramic [substrate] <u>heater</u> for the semiconductor-producing/examining device according to [any of claims 1 to 5] <u>claim 1</u>,

wherein said ceramic substrate is <u>capable of use</u> [used] within the temperature range of 100 to 700°C.

7. (Amended) The ceramic [substrate] <u>heater</u> for the semiconductor-producing/examining device according to [any of claims 1 to 6] <u>claim 1</u>,

wherein said ceramic substrate has a thickness of 25 mm or less, and a diameter of 200 mm or more.

8. (Amended) The ceramic [substrate] <u>heater</u> for the semiconductor-producing/examining device according to [any of claims 1 to 7] <u>claim 1</u>,

wherein said ceramic substrate has a plurality of through holes into which lifter pins for a semiconductor wafer [will be] <u>are capable of being</u> inserted.

9-16. (New).--

Table 1

	Oxygen (% by weight)	Pressure (kgf/cm^2)	Porosity (%)	Maximum pore diameter (µm)
Example 1	1.6	150	0.05	0.1
	1.6	100	0.1	1.1
	1.6	80	1.1	2.2
	1.6	70	2.1	5.0
	1.6	50	3.3	10
	1.6	0	4.1	45
	1.6	150	Below the limit	Not observed
Comparative Example 1	<0.05	100	1.0	1
	1.6	0	4.2	55
	<0.05	0	6.1	60
	6	150	1.1	1

Table 2

	Breakdown voltage (kV/mm) 25 °C	200 °C	450 °C	Fracture toughness value ($MPam^{1/2}$)	Adsorption power 450 °C (kg/cm^2)	Temperature-rising property (seconds)	Warp amount (μm)
Example 1	15	10	5	3.5	1.0	45	1
	15	10	5	3.6	1.1	46	1
	14	9	4	3.8	0.9	45	2
	14	9	3	3.5	1.0	45	2
	13	8	3	3.6	0.8	45	2
	12	5	1	3.6	0.9	50	7
	20	15	10	3.0	1.2	40	0
Comparative Example 1	2	1	0.5	3.5	Dielectric breakdown	45	1
	2	0.8	0.4	3.5	Dielectric breakdown	80	8
	2	0.5	0.1	3.5	Dielectric breakdown	80	8
	15	7	0.9	3.6	Dielectric breakdown	80	1